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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/524,118

03/17/2005

Matthieu Boehm

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DENNISON, SCHULTZ & MACDONALD  
1727 KING STREET  
SUITE 105  
ALEXANDRIA, VA 22314

EXAMINER

SHEVIN, MARK L

ART UNIT

PAPER NUMBER

1793

MAIL DATE

DELIVERY MODE

03/14/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/524,118	<b>Applicant(s)</b> BOEHM ET AL.	
	<b>Examiner</b> Mark L. Shevin	<b>Art Unit</b> 1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 19 December 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-4 is/are pending in the application.
- 4a) Of the above claim(s) 3 and 4 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 2 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>02/10/2005</u> .  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Status***

1. Claims 1-4, in the preliminary amendment filed February 10th 2005, are pending. Claims 3-4 are withdrawn per the restriction requirement mailed 6 December 2007 (described below).

### ***Response to Applicant's Remarks***

2. The Examiner notes Applicant's objection to the finding of lack of unity of invention.

Applicant first notes that the findings of this Office conflict with this of the initial PCT examination however this is not persuasive as the work of the PCT office is not dispositive in terms of unity of invention as is to be determined on a case to case basis, this case being examined now in the US.

Applicants submit that the special technical feature linking the four claims is a "pure aluminum sheet with a special concentration of carbide at its surface". However no special content of aluminium carbide is reflected in claims 3 and 4 and as such the special technical feature can not be said to rely on a concentration of aluminium carbide. An Al alloy strip with carbon in the surface layer will inherently form aluminum carbides and thus the Examiner's finding of the special technical feature was that it was inherent in XP 002242041. JP 52-138440 (Abstract) suggests that aluminum coated with a carbon material or in contact with carbon (hydrocarbon atmosphere) will form aluminum carbides ( $\text{Al}_4\text{C}_3$ ), thus one would reasonably expect XP 002242041 to

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similarly have aluminum carbide at the surface. The Restriction requirement is thus made FINAL.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. **Claims 1 and 2** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Fujihiro** (US 5,518,823) in view of **Hong** (US 6,077,774).

Fujihiro discloses an aluminum foil (thin sheet) to be etched for use as the electrolytic condenser electrodes (cathode/anode of capacitor) that is composed aluminum of a purity of 99.9% or higher and an oxide layer 20-70 angstroms thick (3-7 nm) with at least one etching-nuclei forming element concentrated in the boundary region and/or in the outermost surface region of the oxide layer and having a thickness of 20 angstroms (2 nm) or less (Abstract). Fujihiro teaches that concentration of free carbon (out of the group of P,V,Ti,Cr,Ni,Ta,Zr,C, Be on Col. 5, line 6) below a certain lower limit will bring about insufficient formation of etching pits while a higher

concentration above an upper limit causes excessive etching (Col. 5, lines 5-15). The goal of adding elements such as carbon is to, upon etching, maximize the effective surface area of the aluminum foil (Col. 1, lines 37-46). Fujihira does not teach the use of aluminum carbide:

Hong is drawn to providing a method for forming a relatively thin diffusion barrier on the surface of a metal conductor in a semiconductor device (Col. 1, lines 52-62). The thin diffusion barrier is form between a metal conductor and any surrounding layers, such as for example, a layer of dielectric material (Col. 2, lines 38-44). An important technical advantage of Hong's invention is the formation of diffusion barriers from metal oxides and metal carbides (Col. 1, line 65 to Col. 2, line 2). In one embodiment of the invention, a metal precursor gas is decomposed, via heating, on the surface of a metal conductor, thereby forming a thin layer on the metal conductor. The thin layer reacts with the subsequent dielectric layer to form a diffusion barrier. The first diffusion barrier, **15**, disposed between the metal conductor **14**, and a first dielectric layer **12** may be aluminum carbide (Col. 3, lines 14-22).

It would have been obvious to one of ordinary skill in the capacitor arts, at the time the invention was made, taking the disclosures of Fujihira and Hong as a whole, to combine Fujihira in view of Hong to form a thin aluminum sheet of 99.9% or higher purity with 5-25 at% of aluminum carbide in the 10 nm thick surface layer. This is because Fujihira taught the incorporation of carbon in the boundary region and/or in the outermost surface region of the oxide layer (2-7 nm thick, Col. 2, lines 19-21) and having a thickness of 20 angstroms (2 nm) or less (Abstract). Fujihira emphasized the

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importance of maximizing surface area through etching (Col. 1, lines 38-46) and that the concentration of the nuclei forming element, such as carbon, must be balanced between not producing enough pits and producing too many pits which then fuse together (Col. 5, lines 5-15). Thus Fujihira teaches that by etching, the concentration of a given nuclei element such as carbon is a result effective variable in the maximization of surface area. Hong is similarly drawn to altering the interface between a metal conductor and a dielectric (oxide) film and takes the carbon suggestion further teaching the deposition of aluminum carbide at the metal - dielectric interface to act as a diffusion barrier. The resultant diffusion barrier after heat treatment is 10 nm or less in thickness (Col. 4, lines 7-9). One of ordinary skill in the art would know that aluminum carbide, as taught as forming a diffusion barrier by Hong, as a material that etches more slowly than aluminum. Motivation to combine the two references comes from the suggestion of Fujihira that a nuclei forming element such as carbon at the interface between the Al foil and the oxide layer improves capacitance and Hong teaches another way to treat the interface between a conductor (aluminum) and a dielectric interface (oxide layer).

Regarding claims 1 and 2, Fujihira had taught the use of a 99.9%+ purity Al-foil with a 2-7 nm oxide layer and carbon in a ~2 nm or less layer disposed between the Al foil and under the surface oxide. Thus the carbon content is within the 10 nm surface of claim 1. The content of carbon in the boundary inner layer **6**, between 1 and 40 ppm (Col. 8, lines 52-55) and Hong's invention teaches an essentially pure layer of aluminum carbide deposited. One of ordinary skill in the capacitor arts would be able to optimize within the range (low, 1-40 ppm by Fujihira and high, ~100% by Hong as a diffusion

barrier) of aluminum carbide suggested by the two references as MPEP 2144.05, para I states: "A range can be disclosed in multiple prior art references instead of in a single prior art reference depending on the specific facts of the case." Essentially what Fujihiro and Hong teach is that aluminum carbide is advantageous for altering the etching process to maximize surface area and thus increase the effective capacitance.

### ***Conclusion***

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

US 7,327,556

US 6812110

US 2004/0240152

WO 2007-055121

JP 52-138440

**-- Claims 1-2(All elected) are rejected**  
**-- No claims are allowed**

The rejections above rely on the references for all the teachings expressed in the text of the references and/or one of ordinary skill in the metallurgical art would have reasonably understood or implied from the texts of the references. To emphasize certain aspects of the prior art, only specific portions of the texts have been pointed out. Each reference as a whole should be reviewed in responding to the rejection, since other sections of the same reference and/or various combinations of the cited references may be relied on in future rejections in view of amendments.

All recited limitations in the instant claims have been met by the rejections as set forth above. Applicant is reminded that when amendment and/or revision is required, applicant should therefore specifically point out the support for any amendments made to the disclosure. See 37 C.F.R. § 1.121; 37 C.F.R. Part §41.37 (c)(1)(v); MPEP §714.02; and MPEP §2411.01(B).

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark L. Shevin whose telephone number is (571) 270-3588. The examiner can normally be reached on Monday - Thursday, 8:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V. King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

**/Mark L. Shevin/**

**/Roy King/**

**Supervisory Patent Examiner, Art Unit 1793**

10-524,118  
February 26<sup>th</sup>, 2008